Designation: B 856 – 95ε1

Standard Specification for Concentric-Lay-Stranded Aluminum Conductors, Coated Steel Supported (ACSS)[1]

This standard is issued under the fixed designation B 856; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

ε[1] NOTE—Editorial changes were made throughout in November 1999.

1. Scope

1.1 This specification covers round wire concentric-lay-stranded aluminum conductors, steel supported (ACSS) for use as overhead electrical conductors (see Note 1 and Note 2).

1.2 The values stated in inch-pound units are to be regarded as the standard with the exception of temperature and resistivity. The SI equivalents given in parentheses may be approximate.

NOTE 1—The aluminum and temper designations conform to ANSI Standard H 35.1. Aluminum 1350 corresponds to Unified Number System (UNS) No. A91350 in accordance with Practice E 527.

NOTE 2—In this specification only concentric-lay-stranded aluminum conductors, steel-supported are specifically designated. Conductor constructions not included in this specification should be agreed upon between the manufacturer and the purchaser when placing the order.

2. Referenced Documents

2.1 The following documents of the issue in effect on date of material purchase form part of this specification to the extent referenced herein:

2.2 *ASTM Standards:*

B 263 Test Method for Determination of Cross-Sectional Area of Stranded Conductors[2]

B 341 Specification for Aluminum-Coated (Aluminized) Steel Core Wire for Aluminum Conductors, Steel Reinforced (ACSR/AZ)[2]

B 354 Terminology Relating to Uninsulated Metallic Electrical Conductors[2]

B 498 Specification for Zinc-Coated (Galvanized) Steel Core Wire for Aluminum Conductors, Steel Reinforced (ACSR)[2]

B 500 Specification for Metallic Coated Stranded Steel Core for Aluminum Conductors, Steel Reinforced (ACSR)[2]

B 502 Specification for Aluminum-Clad Steel Core Wire for Aluminum Conductors, Aluminum-Clad Steel Reinforced[2]

B 606 Specification for High-Strength Zinc-Coated (Galvanized) Steel Core Wire for Aluminum and Aluminum-Alloy Conductors, Steel Reinforced[2]

B 609 Specification for Aluminum 1350 Round Wire, Annealed and Intermediate Tempers, for Electrical Purposes[2]

B 802 Specification for Zinc-5 % Aluminum-Mischmetal Alloy-Coated Steel Core Wire for Aluminum Conductors, Steel Reinforced (ACSR)[2]

B 803 Specification for High-Strength Zinc-5 % Aluminum-Mischmetal Alloy-Coated Steel Core Wire for Aluminum and Aluminum-Alloy Conductors, Steel Reinforced[2]

E 29 Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications[3]

E 527 Practice for Numbering Metals and Alloys (UNS)[4]

2.3 *Military Standard:*

MIL-C-12000 Cable, Cord, and Wire, Electric: Package of[5]

2.4 *Other Standards:*

ANSI H35.1 American National Standard Alloy and Temper Designation Systems for Aluminum[6]

NBS *Handbook 100*—Copper Wire Tables of the National Bureau of Standards[7]

3. Terminology

3.1 *Definitions:*

3.1.1 *aluminized*—aluminum coated.

3.1.2 *aluminum-clad*—aluminum sheathed.

3.1.3 *galvanized*—zinc coated.

NOTE 3—For definitions of terms relating to conductors, refer to Definitions B 354.

3.2 *Abbreviations:*

3.2.1 *ACSS*—aluminum conductor, steel supported.

3.2.2 *ACSS/GA*—supported with galvanized steel core wire, coating Class A in accordance with Specification B 498.

3.2.3 *ACSS/GB*—supported with galvanized steel core wire,

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[2] *Annual Book of ASTM Standards*, Vol 02.03.

[3] *Annual Book of ASTM Standards*, Vol 14.02.

[4] *Annual Book of ASTM Standards*, Vol 01.01.

[5] Available from Standardization Documents Order Desk, Bldg. 4 Section D, 700 Robbins Ave., Philadelphia, PA 19111-5094. Attn: NPODS.

[6] Available from the American National Standards Institute, 11 W. 42nd St., 13th Floor, New York, NY 10036.

[7] Available from National Technical Information Services, 5285 Port Royal Road, Springfield, VA 22161.

coating Class B in accordance with Specification B 498.

3.2.4 *ACSS/GC*—supported with galvanized steel core wire, coating Class C in accordance with Specification B 498.

3.2.5 *ACSS/HS*—supported with high-strength galvanized steel core wire in accordance with Specification B 606.

3.2.6 *ACSS/MA*—supported with Zn-5A1-MM coated steel core wire, coating Class A in accordance with Specification B 802.

3.2.7 *ACSS/MB*—supported with Zn-5A1-MM coated steel core wire, coating Class B in accordance with Specification B 802.

3.2.8 *ACSS/MC*—supported with Zn-5A1-MM coated steel core wire, coating Class C in accordance with Specification B 802.

3.2.9 *ACSS/MS*—supported with high-strength Zn-5A1-MM coated steel core wire in accordance with Specification B 803.

3.2.10 *Zn-5A1-MM*—zinc-5 % aluminum-mischmetal alloy.

3.2.11 *ACSS/AZ*—supported with aluminum steel core wire in accordance with Specification B 341.

3.2.12 *ACSS/AW supported with aluminum*—clad core wire in accordance with Specification B 502.

4. Ordering Information

4.1 Orders for material under this specification shall include the following information:

4.1.1 Quantity of each size, stranding, and class,

4.1.2 Conductor size, circular-mil area or AWG and diameter (see Section 9 and Table 1),

4.1.3 Number of wires, aluminum and steel,

4.1.4 Type of steel core wire and class (if applicable) of coating (see 5.2),

4.1.5 Direction of lay of outer layer of aluminum wires if other than right hand (see 7.2),

4.1.6 Special tension test, if desired (see 14.3),

4.1.7 Package size and type (see 16.1),

4.1.8 Special package markings, if required (see 16.4),

4.1.9 Heavy wood lagging, if required (see 16.3), and

4.1.10 Place of inspection (see Section 15).

4.2 In addition, supplementary requirements shall apply only when specified by the purchaser in the inquiry, contract, or purchase order for direct procurement by agencies of the U.S. Government (S1, S2, and S3).

5. Requirement for Wires

5.1 After stranding, the round aluminum wires shall conform to the requirements of Specification B 609 for 1350-0 temper, except for elongation requirements. The elongation shall not be less than 20 % after stranding.

NOTE 4—The behavior of properly spaced wire joints in stranded conductors is related to both their tensile strength and elongation. Because of its higher elongation properties, the lower-strength electric butt weld gives equivalent overall performance to that of a cold-pressure weld or an electric-butt, cold-upset weld in stranded conductors.

5.2 Before stranding, the steel core wire shall meet the requirements of Specification B 341, B 498, B 502, B 606, B 802, or B 803, whichever is applicalbe.

5.3 After stranding, the steel core, except for aluminum-clad cores meeting the requirements of Specification B 502, shall meet the requirements of Specification B 500.

6. Joints

6.1 Electric-butt welds, cold-pressure welds, and electric-butt, cold-upset welds in the finished individual aluminum wires composing the conductor may be made during the stranding process. No weld shall occur within 50 ft (15 m) of a weld in the same wire or in any other wire of the completed conductor (see Note 4).

6.2 There shall be no joints of any kind made in the finished coated steel wires.

7. Lay

7.1 The length of lay of the various layers of wires in a conductor shall conform to Table 2 (see Note 5).

7.2 The direction of lay of the outside layer of aluminum wires shall be right hand unless otherwise specified in the purchase order. The direction of lay of the aluminum and steel wires shall be reversed in successive layers.

NOTE 5—The preferred ratio of the lay with respect to the outside diameter of a layer of wires varies for different layers and for different diameters of the conductor, being larger for the inside layers than for the outside layers, and larger for conductors of smaller diameter than for those of larger diameter.

8. Construction

8.1 The ACSS may be constructed using steel core wire with any one of ten types of protective coatings. The acceptable core wires are galvanized steel core wires, coating Classes A, B, or C in accordance with Specification B 498; high-strength galvanized steel core wire in accordance with Specification B 606; Zn-5A1-MM, coated steel core wire, coating Classes A, B, or C, in accordance with Specification B 802; high-strength Zn-5A1-MM coated steel core wire in accordance with Specification B 803; aluminized steel core wire in accordance with Specification B 341; aluminum-clad core wire in accordance with Specification B 502.

8.2 The number and diameter of the aluminum and steel wires and the area of cross section of the aluminum wires for standard constructions are shown in Table 1.

9. Rated Strength of Conductor

9.1 The rated strength of the completed ACSS conductor shall be taken as the aggregate strengths of the aluminum and steel components, calculated as follows. The strength contribution of the aluminum wires shall be taken as that percentage, indicated in Table 3, of the sum of the strengths of the 1350-0 wires calculated from their minimum average tensile strengths specified in Specification B 609. The strength contribution of the steel core wires shall be taken as that percentage, indicated in Table 3, of the sum of the strengths of the steel wires, calculated from their specified nominal wire diameter and the appropriate minimum ultimate tensile strengths given in Specifications B 341, B 498, B 502, B 606, B 802, or B 803, whichever is applicable.

9.2 Rated strength and breaking strength values shall be rounded to three significant figures, in the final value only, in accordance with the rounding method of Practice E 29.

9.3 Rated strength of typical constructions are given in Table 4.

TABLE 1 Construction Requirements of Aluminum Conductors, Steel Supported (ACSS)

Size		Class	Stranding Design Aluminum/Steel	Stranding						Nominal Outside Diameter (O.D.) of Conductors, in.	Mass,[A] lb/1000 ft
				Aluminum Wires			Steel wires				
cmil[B]	AWG			Number	Diameter, in.[B]	Layers	Number	Diameter, in.[B]	Layers		
2 312 000	...	AA	76/19	76	0.1744	4	19	0.0814	2	1.802	2523
2 167 000	...	AA	72/7	72	0.1735	4	7	0.1157	1	1.735	2310
2 156 000	...	AA	84/19	84	0.1602	4	19	0.0961	2	1.762	2508
1 780 000	...	AA	84/19	84	0.1456	4	19	0.0874	2	1.602	2072
1 590 000	...	AA	54/19	54	0.1716	3	19	0.1030	2	1.545	2040
1 590 000	...	AA	45/7	45	0.1881	3	7	0.1253	1	1.504	1790
1 510 000	...	AA	54/19	54	0.1672	3	19	0.1003	2	1.505	1938
1 510 000	...	AA	45/7	45	0.1832	3	7	0.1221	1	1.466	1700
1 431 000	...	AA	54/19	54	0.1628	3	19	0.0977	2	1.465	1838
1 431 000	...	AA	45/7	45	0.1783	3	7	0.1189	1	1.427	1611
1 351 000	...	AA	54/19	54	0.1582	3	19	0.0949	2	1.424	1735
1 351 000	...	AA	45/7	45	0.1733	3	7	0.1155	1	1.386	1521
1 272 000	...	AA	54/19	54	0.1535	3	19	0.0921	2	1.382	1634
1 272 000	...	AA	45/7	45	0.1681	3	7	0.1121	1	1.345	1432
1 191 500	...	AA	54/19	54	0.1486	3	19	0.0892	2	1.338	1531
1 192 500	...	AA	45/7	45	0.1628	3	7	0.1085	1	1.302	1345
1 113 000	...	AA	54/19	54	0.1436	3	19	0.0862	2	1.293	1430
1 113 000	...	AA	45/7	45	0.1573	3	7	0.1049	1	1.259	1254
1 033 500	...	AA	54/7	54	0.1383	3	7	0.1383	1	1.245	1329
1 033 500	...	AA	45/7	45	0.1515	3	7	0.1010	1	1.212	1163
954 000	...	AA	54/7	54	0.1329	3	7	0.1329	1	1.196	1227.1
954 000	...	AA	45/7	45	0.1456	3	7	0.0971	1	1.165	1074
900 000	...	AA	54/7	54	0.1291	3	7	0.1291	1	1.162	1158
900 000	...	AA	45/7	45	0.1414	3	7	0.0943	1	1.131	1013
795 000	...	AA	30/19	30	0.1628	2	19	0.0977	2	1.140	1233.9
795 000	...	AA	54/7	54	0.1213	3	7	0.1213	1	1.092	1022
795 000	...	AA	45/7	45	0.1329	3	7	0.0886	1	1.063	895
795 000	...	AA	26/7	26	0.1749	2	7	0.1360	1	1.108	1093
795 000	...	AA	24/7	24	0.1820	2	7	0.1213	1	1.092	1023
715 500	...	AA	30/19	30	0.1544	2	19	0.0926	2	1.081	1109.3
715 500	...	AA	26/7	26	0.1659	2	7	0.1290	1	1.051	983.7
715 500	...	AA	24/7	24	0.1727	2	7	0.1151	1	1.036	921
666 600	...	AA	26/7	26	0.1601	2	7	0.1245	1	1.014	916.2
666 600	...	AA	24/7	24	0.1667	2	7	0.1111	1	1.000	857.9
636 000	...	AA	30/19	30	0.1456	2	19	0.0897	2	1.019	987.2
636 000	...	AA	30/7	30	0.1456	2	7	0.1456	1	1.019	995.1
636 000	...	AA	26/7	26	0.1564	2	7	0.1216	1	0.990	874.2
636 000	...	AA	24/7	24	0.1628	2	7	0.1085	1	0.977	818.2
605 000	...	AA	30/19	30	0.1420	2	19	0.0852	2	0.994	938.6
605 000	...	AA	30/7	30	0.1420	2	7	0.1420	1	0.994	946.5
605 000	...	AA	26/7	26	0.1525	2	7	0.1186	1	0.966	831.3
605 000	...	AA	24/7	24	0.1588	2	7	0.1059	1	0.953	778.8
556 500	...	AA	30/7	30	0.1362	2	7	0.1362	1	0.953	870.7
556 500	...	AA	26/7	26	0.1463	2	7	0.1138	1	0.927	765.2
556 500	...	AA	24/7	24	0.1523	2	7	0.1015	1	0.914	716.1
477 000	...	AA	30/7	30	0.1261	2	7	0.1261	1	0.883	764.4
477 000	...	AA	26/7	26	0.1354	2	7	0.1053	1	0.858	655.3
477 000	...	AA	24/7	24	0.1410	2	7	0.0940	1	0.846	613.9
397 500	...	AA	30/7	30	0.1151	2	7	0.1151	1	0.806	621.8
397 500	...	AA	26/7	26	0.1236	2	7	0.0961	1	0.783	546.0
397 500	...	AA	24/7	24	0.1287	2	7	0.0858	1	0.772	511.4
336 400	...	AA	30/7	30	0.1059	2	7	0.1059	1	0.741	526.4
336 400	...	AA	26/7	26	0.1137	2	7	0.0884	1	0.720	462.0
300 000	...	AA	26/7	26	0.1074	2	7	0.0835	1	0.680	412.2
266 800	...	AA	26/7	26	0.1013	2	7	0.0788	1	0.642	366.9
211 300	...	AA (HS)	12/7	12	0.1327	1	7	0.1327	1	0.664	526.8
203 200	...	AA (HS)	16/19	16	0.1127	1	19	0.0977	2	0.714	674.6
190 800	...	AA (HS)	12/7	12	0.1261	1	7	0.1261	1	0.631	475.7
176 900	...	AA (HS)	12/7	12	0.1214	1	7	0.1214	1	0.607	440.9
159 000	...	AA (HS)	12/7	12	0.1151	1	7	0.1151	1	0.576	396.3
134 600	...	AA (HS)	12/7	12	0.1059	1	7	0.1059	1	0.530	335.5
110 800	...	AA (HS)	12/7	12	0.0961	1	7	0.0961	1	0.481	276.3
101 800	...	AA (HS)	12/7	12	0.0921	1	7	0.0921	1	0.461	253.8

[A] Mass based on H.S. Class A zinc-coated steel core.
[B] Conversion factors:
1 cmil = 5.067E − 04 mm^2
1 in. = 2.54E + 01 mm
1 lb/1000ft = 1.488E = 00 kg/km
1 ft = 3.048E − 01 m
1 lb = 4.536E − 01 kg
1 lbf = 4.448E − 03 KN

TABLE 2 Lay Factors for Aluminum Conductors, Steel-Supported (ACSS), Concentric-Lay-Stranded

Stranding Class	Stranding	Ratio of Length of Lay of a Layer to Nominal Outside Diameter of That Layer															
		Aluminum Wire Layers								Steel Wire Layers[A]							
		First (Outside)			Second			Third		Fourth (Inside)		12 Wire			6 Wire		
		min	pref[B]	max	min	pref	max	min	max	min	max	min	pref	max	min	pref	max
A	6/1, 7/1	8	...	16	...	...	...	...	...	...	...	...	...	...	...	...	...
AA	76/19, 84/19	10	11	13	10	13	16	10	17	10	17	16	20	24	18	25	30
	72/7	10	11	13	10	13	16	10	17	10	17	...	...	...	18	25	30
	54/19	10	11	13	10	13	16	10	17	...	...	16	20	24	18	25	30
	54/7, 45/7	10	11	13	10	13	16	10	17	...	...	...	...	...	18	25	30
	36/1	10	11	13	10	13	16	10	17	...	...	...	...	...	...	...	...
	30/19	10	11	13	10	13	16	...	...	...	...	16	20	24	18	25	30
	30/7, 26/7, 24/7	10	11	13	10	13	16	...	...	...	...	...	...	...	18	25	30
	18/1	10	11	13	10	13	16	...	...	...	...	...	...	...	...	...	...
	16/19	10	12.5	14.5	...	...	...	...	...	...	...	16	20	24	18	25	30
	12/7	10	12.5	14.5	...	...	...	...	...	...	...	...	...	...	18	25	30
	6/1, 7/1, 8/1	12	12.5	14.5	...	...	...	...	...	...	...	...	...	...	...	...	...

[A] See Specification B 500.
[B] Preferred (pref).

TABLE 3 Standard Increments and Rating Factors for Mass, Resistivity, and Rated Strength Determination

Stranding Design Aluminum/Steel	Standard Increments Due to Stranding (for Mass and Resistivity) Increase		Rating Factors (for Rated Strength)	
	Aluminum, %	Steel, %	Aluminum, %	Steel, %
12/7	2.5	0.4	96	100
24/7	2.5	0.4	96	100
26/7	2.5	0.4	96	100
30/7	2.75	0.4	96	100
42/7	2.5	0.4	96	100
45/7	2.5	0.4	96	100
48/7	2.5	0.4	96	100
54/7	2.5	0.4	96	100
72/7	3.0	0.4	96	100
16/19	2.5	0.6	96	100
30/19	2.75	0.6	96	100
54/19	3.0	0.6	96	100
76/19	3.0	0.6	96	100
84/19	3.0	0.6	96	100

10. Density

10.1 For the purpose of calculating mass, cross sections, etc. the density of aluminum 1350 shall be taken as 0.0975 lb/in.^{3} (2705 kg/m^3) at 20°C (see Note 6).

NOTE 6—The density is based upon aluminum of 99.50 % purity. The inch-pound density of the aluminum wires is used for linear density calculations and is based upon the standard SI density with the conversion rounded to the nearest 0.0005 lb/in.^{3}

10.2 For the purpose of calculating mass, cross sections, etc., the density of galvanized, aluminized, or Zn-5A1-MM alloy coated steel wire shall be taken as 0.281 lb/in.^{3}(7780 kg/m^3) at 20°C.

10.3 For the purposes of calculating mass, cross sections, and the like, the density of aluminum-clad steel wire shall be taken as 0.2381 lb/in.^{3}(6590 kg/m^3) at 20°C.

11. Mass and Electrical Resistance

11.1 The mass and electrical resistance of a unit length of stranded conductor are a function of the length of lay. The approximate weight and electrical resistance may be determined using the standard increments shown in Table 3. When greater accuracy is desired, the increment based on the specific lay of the conductor may be calculated (see Note 7).

NOTE 7—The increment of weight or electrical resistance of a completed concentric-lay-stranded conductor (k) in percent is as follows:

$$k = 100\,(m - 1)$$

where m is the stranding factor, and also the ratio of the weight or electrical resistance of a unit length of stranded conductor to that of a solid conductor of the same cross-sectional area or of a stranded conductor with infinite length of lay, this is, all wires parallel to the conductor axis. The stranding factor m for the completed stranded conductor is the numerical average of the stranding factors for each of the individual wires in the conductor, including the straight core wire, if any (for which the stranding factor is unity). The stranding factor (m_{ind}) for any given wire in a concentric-lay-stranded conductor is:

$$m_{ind} = \sqrt{1 + (9.8696/n^2)}$$

where: n =

$$\frac{\text{length of lay}}{\text{diameter of helical path of wires}}$$

The derivation of the above is given in *NBS Handbook 100.*[7] The factors k and m are to be determined separately for the zinc-coated or aluminum-coated steel (see Section 8).

11.2 In the calculation of the electrical resistance of a conductor, the zinc-coated, Zn-5A1-MM-coated, or aluminum-coated steel core wires shall be taken as 0.19157 $\Omega\cdot$mm^2/m at 20°C and the resistivity of aluminum-clad steel core wires shall be taken as 0.0848 $\Omega\cdot$mm^2/m at 20°C. These are typical values and are not guaranteed.

12. Workmanship, Finish, and Appearance

12.1 The conductor shall be free of all imperfections not consistent with good commercial practice.

13. Variation in Area

13.1 The area of cross section of the aluminum wires of a conductor shall be not less than 98 % of the area specified. Unless otherwise specified by the purchaser, the manufacturer may have the option of determining the cross-sectional area by either of the following methods, except that in case of question regarding area compliance, the method of 13.1.2 shall be used:

13.1.1 The area of cross section may be determined by calculations from diameter measurements, expressed to four decimal places, of the component aluminum wires at any point when measured perpendicularly to their axes.

TABLE 4 Rated Strengths of Aluminum Conductors, Steel Supported (ACSS)

Size		Class	Stranding Design Aluminum/Steel	Rated Strength (by type of steel core wire)		
cmil	AWG			ACSS/HS ACSS/MS kips	ACSS/GA ACSS/MA kips	ACSS/AW kips
2 312 000	...	AA	76/19	38.1	35.6	34.1
2 167 000	...	AA	72/7	30.8	29.0	28.2
2 156 000	...	AA	84/19	45.5	42.1	40.7
1 780 000	...	AA	84/19	38.2	35.4	33.6
1 590 000	...	AA	54/19	46.6	42.6	41.1
1 590 000	...	AA	45/7	29.6	27.9	27.0
1 510 000	...	AA	54/19	44.2	40.4	38.9
1 510 000	...	AA	45/7	28.1	26.5	25.7
1 431 000	...	AA	54/19	41.9	38.4	36.9
1 431 000	...	AA	45/7	27.0	25.1	24.3
1 351 000	...	AA	54/19	39.6	36.2	34.9
1 351 000	...	AA	45/7	25.5	23.7	23.0
1 272 000	...	AA	54/19	37.3	34.1	32.8
1 272 000	...	AA	45/7	24.0	22.3	21.6
1 192 000	...	AA	54/19	35.5	32.6	30.8
1 192 000	...	AA	45/7	23.5	21.4	20.8
1 113 000	...	AA	54/19	33.2	30.4	28.8
1 113 000	...	AA	45/7	21.1	19.5	18.9
1 333 500	...	AA	54/7	30.3	28.2	26.1
1 033 500	...	AA	45/7	19.5	18.1	17.6
954 000	...	AA	54/7	28.0	26.0	24.6
954 000	...	AA	45/7	18.0	16.7	16.2
900 000	...	AA	54/7	26.4	24.6	23.2
900 000	...	AA	45/7	17.0	15.8	15.3
795 000	...	AA	30/19	37.9	34.3	32.9
795 000	...	AA	54/7	23.3	21.7	20.9
795 000	...	AA	45/7	15.2	14.2	13.5
795 000	...	AA	26/7	28.0	25.9	24.4
795 000	...	AA	24/7	23.3	21.7	20.9
715 500	...	AA	30/19	34.0	30.8	29.5
715 500	...	AA	26/7	25.2	23.3	22.0
715 500	...	AA	24/7	21.3	19.5	18.8
666 600	...	AA	26/7	23.4	21.7	20.9
666 600	...	AA	24/7	19.9	18.2	17.5
636 000	...	AA	30/19	30.9	28.0	26.3
636 000	...	AA	30/7	29.7	27.4	25.1
636 000	...	AA	26/7	22.4	20.7	19.9
636 000	...	AA	24/7	19.0	17.3	16.7
605 000	...	AA	30/19	29.3	26.6	25.0
605 000	...	AA	30/7	28.3	26.0	24.4
605 000	...	AA	26/7	21.3	19.7	19.0
605 000	...	AA	24/7	18.1	16.5	15.9
556 500	...	AA	30/7	26.5	24.5	22.9
556 500	...	AA	26/7	19.9	18.2	17.5
556 500	...	AA	24/7	16.6	15.2	14.6
477 000	...	AA	30/7	22.7	21.0	20.1
477 000	...	AA	26/7	17.1	15.6	14.9
477 000	...	AA	24/7	14.2	13.0	12.5
397 500	...	AA	30/7	19.3	17.5	16.7
397 500	...	AA	26/7	14.2	13.0	12.4
397 500	...	AA	24/7	12.1	11.0	10.4
336 400	...	AA	30/7	16.3	14.8	14.2
336 400	...	AA	26/7	12.3	11.2	10.5
300 000	...	AA	26/7	10.9	10.0	9.40
266 800	...	AA	26/7	9.73	8.88	8.37
211 300	...	AA (HS)	12/7	23.1	21.2	19.7
203 200	...	AA (HS)	16/19	34.1	30.5	29.1
190 800	...	AA (HS)	12/7	20.9	19.1	18.3
176 900	...	AA (HS)	12/7	19.4	17.7	16.9
159 000	...	AA (HS)	12/7	17.8	15.9	15.2
134 600	...	AA (HS)	12/7	15.0	13.5	12.9
110 800	...	AA (HS)	12/7	12.4	11.1	10.6
101 800	...	AA (HS)	12/7	11.4	10.2	9.75

13.1.2 The area of cross section of the aluminum wires of a conductor may be determined by Test Method B 263. In applying that method the increment in linear density resulting from stranding may be the applicable value specified in 13.1 or may be calculated from the measured component dimensions of the sample under test. In case of question regarding area compliance, the actual linear density increment due to stranding shall be calculated.

14. Mechanical and Electrical Tests

14.1 Tests for mechanical and electrical properties of aluminum wires shall be made after stranding (see Note 8).

NOTE 8—Wires unlaid from conductors may have different physical properties from those of the wire when prepared for cabling, on account of the deformation caused by laying and again straightening for test. If test on galvanized or aluminum-coated steel wires are to be made after stranding, the purchaser and the manufacturer at the time of placing the order should agree on the properties to be met.

14.2 The electrical resistivity shall meet the minimumresistivity specified for the wire after stranding. The frequency of these tests shall be agreed upon between the purchaser and the manufacturer.

14.3 Tests for demonstration of rated strength of the completed conductor are not required by this specification but may be made if agreed upon between the manufacturer and the purchaser at the time of placing an order. If tested, the breaking strength of the completed conductor shall be not less than the rated strength if failure occurs in the free length at least 1 in. (25 mm) beyond the end of either gripping device, or shall be not less than 95 % of the rated strength if failure occurs inside, or within 1 in. (25 mm) of the end of, either gripping device (see Note 9).

NOTE 9—To test ACSS conductors for breaking strength successfully as a unit requires special devices for gripping the ends of the aluminum and steel wires without causing damage that may result in failure below the actual strength of the conductor. Various special dead-end devices are available such as compression sleeves and split sleeves, but ordinary jaws or clamping devices usually are not suitable.

14.4 Tests for all properties of zinc-coated, Zn-5A1–MM coated, or aluminum-coated steel wires shall be made before stranding (see Note 7).

15. Inspection

15.1 Unless otherwise specified in the contract or purchase order, the manufacturer shall be responsible for the performance of all inspection and test requirements specified.

15.2 All inspections and tests shall be made at the place of manufacture unless otherwise especially agreed upon between the manufacturer and the purchaser at the time of the purchase.

15.3 The manufacturer shall afford the inspector representing the purchaser all reasonable manufacturer's facilities to satisfy him that the material is being furnished in accordance with this specification.

16. Packaging and Package Marking

16.1 Package sizes and kind of package, reels or coils, shall be agreed upon between the manufacturer and the purchaser. Recommended package sizes are shown in Table 5 (see Note 10).

16.2 There shall be only one length of conductor on a reel (see Note 11).

NOTE 10—For the convenience of the user of this specification, Table 5 has been prepared giving recommended shipping lengths for the standard sizes of ACSS referred to in Table 1. Because of the variation in coil weights, etc., it is common practice to allow a permissable tolerance in length of ±5 % for sizes larger than No. 1 AWG and a tolerance of ±10 % on sizes No. 1 AWG and smaller. It is also common practice to allow an amount not exceeding 10 % of the total weight of any one order to be shipped in random lengths with no piece shorter than 50 % of the standard length ordered.

NOTE 11—Multiple lengths per package are allowable only when the bare conductor is intended for re-manufacture, such as adding a covering or insulation. In such cases, the position of each end of a length is to be clearly marked and the length of each portion shall be shown on the tag attached to the end of the conductor.

16.3 The conductors shall be protected against damage in ordinary handling and shipping. If heavy wood lagging is required, it shall be specified by the purchaser at the time of placing the purchase order.

16.4 The net linear density, length, size, kind of conductors, stranding, type of coating, class of coating, and any other necessary identification shall be marked on a tag attached to the end of the conductor inside the package. This same information, together with the purchase order number, the manufacturer's serial number (if any), and all shipping marks and other information required by the purchaser shall appear on the outside of the package.

17. Keywords

17.1 aluminum conductors; concentric-lay stranded aluminum conductors; electrical conductors; electrical conductors; aluminum; steel-reinforced conductors; steel-supported aluminum conductors; stranded aluminum conductors

TABLE 5 Packaging Information—Recommended Reel Sizes, Shipping Lengths, and Net Masses

Size		Stranding Design Aluminum/ Steel	Reel Types								
			RMT			RM			NR		
cmil	AWG		Reel Size	Length on Reel	Net Mass	Reel Size	Length on Reel	Net Mass	Reel Size	Length on Reel	Net Mass
2 312 000	...	76/19	96.60	7000	17 660	...	...	...	...	...	...
2 167 000	...	72/7	96.60	7000	16 100	...	...	...	...	...	...
2 156 00	...	84/19	96.60	7500	18 810	...	...	...	...	...	...
1 780 000	...	84/19	96.60	9200	19 060	...	...	...	...	...	...
1 590 000	...	54/19	90.45	5740	11 720	68.38	2870	5860	...	...	...
1 590 000	...	45/7	90.45	6000	10 740	68.38	3000	5370	60.28	2000	3580
1 510 000	...	54/19	90.45	6040	11 710	68.38	3020	5850	...	...	...
1 510 000	...	45/7	90.45	6320	10 740	68.38	3160	5370	60.28	2110	3590
1 431 000	...	54/19	90.45	6375	11 720	68.38	3190	5860	...	...	...
1 431 000	...	45/7	90.45	6665	10 730	68.38	3335	5370	60.28	2220	3580
1 351 000	...	54/19	90.45	6755	11 720	68.38	3375	5860	...	...	...
1 351 000	...	45/7	90.45	7060	10 740	68.38	3530	5370	60.28	2355	3580
1 272 000	...	54/19	90.45	7175	11 720	68.38	3585	5860	...	...	...
1 272 000	...	45/7	90.45	7500	10 740	68.38	3750	5370	60.28	2500	3580
1 192 500	...	54/19	90.45	7650	11 720	68.38	3825	5860	...	...	...
1 192 500	...	45/7	90.45	8000	10 740	68.38	4000	5370	60.28	2665	3580
1 113 000	...	54/19	90.45	8200	11 730	68.38	4100	5860	...	...	...
1 113 000	...	45/7	90.45	8570	10 740	68.38	4285	5370	60.28	2855	3580
1 033 500	...	54/7	90.45	8870	11 790	68.38	4435	5890	...	...	...
1 033 500	...	45/7	90.45	9230	10 730	68.38	4615	5370	60.28	3075	3580
954 000	...	54/7	90.45	9600	11 780	68.38	4800	5890	...	...	...
954 000	...	45/7	90.45	10 000	10 740	68.38	5000	5370	60.28	3335	3580
900 000	...	54/7	90.45	10 180	11 790	68.38	5090	5890	...	...	...
900 000	...	45/7	90.45	10 590	10 730	68.38	5295	5360	60.28	3530	3580
795 000	...	30/19	84.45	7980	9850	66.32	3990	4920	...	...	...
795 000	...	54/7	90.45	11 520	11 780	68.38	5760	5890	...	...	...
795 000	...	45/7	90.45	12 000	10 740	68.38	6000	5370	60.28	4000	3580
795 000	...	26/7	84.36	6940	7590	...	...	...	60.28	3470	3790
795 000	...	24/7	84.36	6400	6540	...	...	...	60.28	3200	3270
715 500	...	30/19	84.45	8880	9850	66.32	4440	4930	...	...	...
715 500	...	26/7	84.36	7710	7580	...	...	...	60.28	3855	3790
715 500	...	24/7	84.36	7100	6540	...	...	...	60.28	3550	3270
666 600	...	26/7	84.36	8280	7590	...	...	...	60.28	4140	3790
666 600	...	24/7	84.36	7630	6550	...	...	...	60.28	3815	3270
636 000	...	30/19	84.45	9980	9850	66.32	4990	4930	...	...	...
636 000	...	30/7	...	...	...	66.32	5005	4980	...	...	...
636 000	...	26/7	84.36	8670	7580	...	...	...	60.28	4335	3790
636 000	...	24/7	84.36	8000	6550	...	...	...	60.28	4000	3270
605 000	...	30/19	84.45	10 490	9850	66.32	5245	4920	...	...	...
605 000	...	30/7	...	...	...	66.32	5245	4960	...	...	...
605 000	...	26/7	84.36	9110	7570	...	...	...	60.28	4555	3790
605 000	...	24/7	84.36	8410	6550	...	...	...	60.28	4205	3270
556 500	...	30/7	...	...	...	66.32	5700	4960	...	...	...
556 500	...	26/7	84.36	9910	7580	...	...	...	60.28	4955	3790
556 500	...	24/7	84.36	9140	6550	...	...	...	60.28	4570	3270
477 000	...	30/7	...	...	...	66.32	6650	4960	...	...	...
477 000	...	26/7	84.36	11 560	7580	...	...	...	60.28	5780	3790
477 000	...	24/7	84.36	10 660	6540	...	...	...	60.28	5330	3270
397 500	...	30/7	...	...	...	66.32	7980	4960	...	...	...
397 500	...	26/7	84.36	13 870	7570	...	...	...	60.28	6935	3790
397 500	...	24/7	84.36	12 790	6540	...	...	...	60.28	6395	3270
336 400	...	30/7	...	...	...	66.32	9430	4960	...	...	
336 400	...	26/7	84.36	16 390	7570	...	...	...	60.28	8195	3790
300 000	...	26/7	...	...	...	...	...	...	60.28	9190	3790
266 800	...	26/7	...	...	...	...	...	...	60.28	10 330	3790
211 300	...	12/7	...	...	...	...	...	...	48.28	6020	3170
203 200	...	16/19	...	...	...	66.32	7875	5310	...	...	...
190 800	...	12/7	...	...	...	...	...	...	48.28	6665	3170
176 900	...	12/7	...	...	...	...	...	...	48.28	7195	3170
159 000	...	12/7	...	...	...	...	...	...	48.28	8000	3170
134 600	...	12/7	...	...	...	...	...	...	48.28	9450	3170
110 800	...	12/7	...	...	...	...	...	...	48.28	11 480	3170
101 800	...	12/7	...	...	...	...	...	...	48.28	12 500	3170

TABLE 6 Dimensions of Standard Reels (For Information Only)

Reel Designation[A,B]	Reel Capacity, in.^{3}[C]	Reel Dimensions, in.				
		Flange Diameter	Drum Diameter	Width		Arbor Hole Diameter
				Inside	Outside[D]	
NR 30.22	9 950	30	18	22	25	3 to 3¼
NR 36.22	16 800	36	18	22	25	3 to 3¼
NR 38.22	18 000	38	20	22	25	3 to 3¼
NR 42.28	29 100	42	21	28	32½	3 to 3¼
NR 48.28	38 000	48	24	28	32½	3 to 3¼
NR 60.28[E]	61 900	60	28	28	32½	3 to 3¼
RM 66.32[F]	76 900	66	36	32	38	3 to 3¼
RM 68.38[F]	99 300	68	36	38	44	3 to 3¼
RMT 84.36[G]	122 100	78 (84)	42	36	43	5 to 5¼
RMT 84.45[G]	152 700	78 (84)	42	45	52	5 to 5¼
RMT 90.45[G]	187 000	84 (90)	42	45	52	5 to 5¼
RMT 96.60[G]	300 000	90 (96)	42	60	67	5 to 5¼

[A] Prefix “NR” denotes wooden nonreturnable reel, “RM” metal returnable reel, and “RMT” metal returnable reel with one-beam tires.
[B] Reels are not designed to withstand the forces required for braking during tension stringing operations.
[C] 1 in.^{3} = 1.639 E-05 m^3; 1 in. = 2.54 E-02 m.
[D] Pay-off equipment for reels NR 48.28 and smaller should be a minimum of 2 in. wider than the nominal outside reel width to provide for extension of bolts and for possible flange distortion. For reels NR 60.28 and larger, either wood or metal pay-off equipment should be not less than 4 in. wider than the reel width.
[E] Hub reinforcements will be provided for reel NR 60.28.
[F] Reels RM 66.32 and RM 68.38 have flat rims.
[G] Reels RMT 84.36, RMT 84.45, RMT 90.45, and RMT 96.60 have 3-in. I-beam tires. Reels with similar dimensions except without I-beam tires are sometimes used.

SUPPLEMENTARY REQUIREMENTS

The following supplementary requirements shall apply only when specified by the purchaser in the inquiry, contract, or order for agencies of the U.S. Government.

S1. Referenced Documents

S1.1 The following documents form a part of this specification to the extent specified herein. Unless otherwise, the issues of these documents shall be those listed in the issue of the Department of Defense Index of Specifications and Standards (DODISS) and supplement thereto, cited in the solicitation.

S1.2 *Military Specification:*

MIL-C-12000 Cable, Cord, and Wire, Electric: Packaging of[7]

S2. Inspection

S2.1 The government shall have the right to perform any of the inspections and test set forth in this specification when such test are deemed necessary to ensure that the material conforms to the prescribed requirements.

S3. Packaging

S3.1 Packaging shall be in accordance with MIL-C-12000.